FLEXIBLE DELINEATOR POSTS MSP-96-11A

1.0 DESCRIPTION OF MSP-96-11A. This work shall consist of furnishing and installing reflectorized flexible delineator posts with prismatic retroreflective sheeting at locations, and of the dimensions, shown on the plans.

2.0 MATERIALS.

2.1 Flexible Delineator Posts.

2.1.1 Flexible delineator posts shall be manufactured from virgin polymer, copolymer, or elastomers which will enable them to meet the requirements of this specification. Clean rework material generated from the manufacturer's own production will be permitted. Other reprocessed or recycled materials are not permitted. Posts shall be pigmented and stabilized against fading or deterioration by ultraviolet or other light rays by the incorporation of adequate inhibitors. The post shall be white in color and shall meet the requirements for testing described herein. Each post shall be marked with the manufacturer's identification and the month and year produced. The marking shall be permanently affixed on the face away from oncoming traffic with 1/4-inch minimum height letters. The marking shall be visible after installation of the post. The marking shall be legible and may be either embossed in the post or marked in weatherproof and solvent resistant ink. Flexible delineator posts shall be one of the following types.

2.1.1.1 Type 1. Type 1 posts shall be cylindrical in shape, except that the upper 10 to 15 inches shall be flattened to an oval shape at least 3 inches in width at the major axis. The flattened area shall provide a reasonably flat and smooth surface suitable for the application of reflective sheeting specified herein. If post caps are furnished as a part of the posts, the caps shall be firmly fastened to the top of the posts by adhesive.

2.1.1.2 Type 1 posts shall be capable of insertion into an anchor which will hold the post in a vertical position by a locking mechanism. The mechanism shall be such that when a post is no longer serviceable, the post can be removed and a new post inserted into the anchor and locked into place.

2.1.1.3 Anchoring systems for Type 1 posts may be one of the following classes:

Class A. A chisel pointed, drivable, reusable metal anchor 18 inches in length, into which a post can be inserted and held in place by a locking mechanism.

Class B. A metal anchor designed for embedment in either portland cement or bituminous concrete into which a post can be inserted and held in place by a locking mechanism.

Class C. A surface mount held in place with a bonding epoxy and having a locking device to secure the post.

2.1.2 Testing.

2.1.2.1 Flexibility Test. Posts, 48 inches in length, shall be tested at 110 °F and 0°F. After being conditioned for at least 2 hours in a test chamber, the post shall be held securely in a vertical position and bent to a 90 degree angle. The post shall straighten to within 10 degrees of vertical within one (1) minute after being bent. The specimens shall be returned to the test chamber for 30 minutes between tests. The time outside the chamber shall not exceed 5 minutes. This test shall be repeated 5 times for each conditioning temperature, using a different post for each temperature. Flexibility Acceptance. All posts tested shall pass the straightening requirement. Cracking or permanent deformation shall be cause for rejection.

2.1.2.2 Vehicle Impact Test. The posts shall be capable of withstanding impact by a vehicle traveling at 55 mph.

2.1.2.2.1 Ten posts shall be installed in a straight line in a manner recommended by the manufacturer, at a spacing that does not allow interference with adjacent posts. The posts shall be 48 inches in height from the ground surface. Half of the posts shall be normal to the direction of travel, and half shall be rotated 15 degrees from the normal direction.

2.1.2.2.2 The impact vehicle shall be a typical, medium sized American sedan with a bumper, but no sharp contours, sharp hood ornaments, or other discontinuities on the front.

2.1.2.2.3 The impact vehicle shall strike the group of posts with the approximate center of the car successively, in the same direction, for a maximum series of 15 times at 55 mph. After each run, the tester shall note the number of posts that sustained impact and the number of posts that return to within 20 degrees of vertical within one (1) minute. A post is considered failed if it has torn loose, has pulled out of the ground, has lost more than 10 percent of its exposed length, or is at an angle of less than 45 degrees with vertical. In any of those cases, it is to be removed from further consideration. After 10 runs, the tester shall note the number of posts remaining and the amount of reflectorized sheeting on each post. If the acceptance criteria has not been met after 10 runs, testing may be continued for a maximum of 15 vehicle runs.

2.1.2.2.4 Acceptance. After 10 vehicle runs, there shall be a minimum of 6 posts remaining, and a minimum of 6 posts shall each have at least 50 percent of the reflectorized sheeting left. After a maximum of 15 vehicle runs, a minimum of 100 post impacts shall have been counted (or an average life of 10 impacts for the initial 10 posts) and a minimum of 100 counts shall have been noted for posts returning to within 20 degrees of vertical.

2.1.2.3 Bend Resistance Test. A post shall be cantilevered horizontally with a 48 inch unsupported overhang and at room temperature (77 ± 5 °F). A 5.5 pound weight shall be suspended from the end of the post, and the post allowed to support the weight.

2.1.2.3.1 Bend Resistance Acceptance. The post shall deflect 60 degrees or less, from the original horizontal position. The post shall be rejected if the angle exceeds 60 degrees. All posts tested shall pass this requirement.

2.2 Prismatic Retroreflective Sheeting.

2.2.1 The retroreflective sheeting shall be a flexible, colored, wide angle prismatic retroreflective sheeting designed to enhance the day/night visibility of flexible delineator posts and shall have a smooth surface with a distinctive interlocking diamond seal pattern and orientation marks visible from the face. The sheeting shall be precoated with a pressure sensitive adhesive backing protected by a removable liner. The sheeting shall be free from ragged edges, cracks and extraneous materials. The sheeting shall be identified by brand, lot, run number or date of manufacture, and color.

2.2.2 Test Methods.

2.2.2.1 Test Conditions. Unless otherwise specified herein, all applied and unapplied test samples and specimens shall be conditioned at the standard conditions of 73 ± 3 ^{o}F and 50 ± 5 percent relative humidity for 24 hours prior to testing.

2.2.2.2 Test Panels. Unless otherwise specified herein, when tests are to be performed using test panels, the specimens of retroreflective material shall be applied to smooth aluminum cut from ASTM B 209 Alloy 5052-H36, 5052-H38, 5154-H38 or 6061-T6 sheets in 0.020 inch, 0.040 inch or 0.063 inch thickness. The aluminum shall be degreased and lightly acid etched before the specimens are applied. The specimens shall be applied to the panels in accordance with the recommendations of the retroreflective sheeting manufacturer.

2.2.3 Physical Requirements.

2.2.3.1 Color Requirements.

2.2.3.1.1 The four pairs of chromaticity coordinates shown in Table I determine the acceptable color in terms of the CIE 1931 standard colorimetric system measured with standard illuminant D65.

TABLE I
Color Specification Limits (Daytime)

Color	1		2		3		4		Reflectance Limit Y (%)	
	x	y	x	y	x	y	x	y	Min.	Max.
White	0.305	0.305	0.355	0.355	0.335	0.375	0.285	0.325	40	-
Yellow	0.487	0.423	0.545	0.454	0.465	0.534	0.427	0.483	24	45

2.2.3.1.2 Conformance to color requirements shall be determined by instrumental method in accordance with ASTM E 1164 on sheeting applied to test panels and conditioned as specified in Sec 2.2.2.1 of this specification. The values shall be determined on a Hunterlab

Labscan II 0/45 spectrocolorimeter with option CMR 559. Computations shall be made in accordance with ASTM E 308.

2.2.4 Specific Intensity Per Unit Area (SIA). The specific intensity per unit area shall not be less than the minimum values specified in Table II. Testing shall be in accordance with AASHTO T 257 except that the Table II values shall be met at 0 degrees and at 90 degrees orientation without averaging.

Table II
Minimum Specific Intensity Per Unit Area (SIA)
(Candelas per footcandle per square foot)
(0 and 90 degree Orientation)

Observation Angle (degree)	Entrance Angle (degree)	White	Yellow
0.2	-4	800	660
0.2	+30	450	340
0.2	+45	200	85
0.2	+60 *	65	23
0.5	-4	185	160
0.5	+30	125	85
0.5	+45	90	45
0.5	+60 *	35	20

* The 60 degree entrance angle shall be measured at 90 degrees orientation only.

2.2.4.1 For measurement, the datum mark (orientation arrow) shall be positioned horizontally for the 0 degree orientation and vertically for the 90 degrees (preferred) orientation.

2.2.5 Gloss Retention. The retroreflective sheeting shall have an 85 degree specular gloss of not less than 50 when tested in accordance with ASTM D 523.

2.2.6 Flexibility. The retroreflective sheeting with the liner removed and conditioned as specified in Sec 2.2.2.1 of this specification shall be sufficiently flexible to show no cracking when bent, in a time period of one second, around a 1/8 inch mandrel, with the adhesive contacting the mandrel, at test conditions. Talcum powder shall be spread on the adhesive to prevent sticking to the mandrel.

2.2.7 Adhesive. The protective liner attached to the adhesive shall be removed by peeling without soaking in water or other solutions, without breaking, tearing, or removing any adhesive from the backing. The protective liner shall be easily removed following accelerated storage for 4 hours at 160 ^{o}F under a weight of 2.5 pounds per square inch. The adhesive backing of the retroreflective sheeting shall produce a bond to support a 1.75 pound weight for 5 minutes without the bond peeling for a distance of more than 2 inches when applied to a test panel prepared as specified in Sec 2.2.2.2 of this specification. Apply 4 inches of a 1 x 6 inch specimen to a test panel. Condition and then position the panel face down horizontally, suspend the weight from the free end of the sample and allow it to hang free at an angle of 90 degrees to the panel surface for 5 minutes.

2.2.8 Impact Resistance. The retroreflective sheeting applied according to the sheeting manufacturer's recommendations to a test panel of alloy 6061-T6, 0.040 inch by 3 inch by 5 inch and conditioned as specified in Sec 2.2.2.1 of this specification, shall show no cracking outside the impact area when the face of the panel is subjected to an impact of a 4 pound weight, with a 5/8 inch diameter rounded tip, dropped from a height necessary to generate an impact of 100 inch-pounds at test temperatures of 32 ^{o}F and 72 ^{o}F.

2.2.9 Resistance to Heat. The retroreflective sheeting, applied to a test panel and conditioned as specified in Sec 2.2.2.1 of this specification, shall be measured in accordance with Sec 2.2.4 of this specification at 0.2 degrees observation and -4 degrees entrance angles at both 0 degrees and 90 degrees orientations and exposed to 170 ± 5 ^{o}F for 24 hours in an air circulating oven. After heat exposure the sheeting shall retain a minimum of 70 percent of the original coefficient of retroreflection at both orientations when measured at room temperature.

2.2.10 Resistance to Corrosion. The retroreflective sheeting applied to a test panel and conditioned as specified in Sec 2.2.2.1 of this specification, shall show no loss of adhesion, appreciable discoloration or corrosion and after cleaning shall retain a minimum of 80 percent of the original specific intensity per footcandle per square foot when measured at 0.2 degrees observation, -4 degrees entrance and 0 degrees and 90 degrees orientation angles only, after 1000 hours exposure to a 5 percent concentration salt spray at 95 ^{o}F when tested in accordance with ASTM B 117.

2.3 Approval and Acceptance.

2.3.1 Manufacturer and Brand Name Approval. To obtain manufacturer and brand name approval of flexible delineator posts, the manufacturer shall submit to the Division Engineer, Materials, 3 complete posts (including anchoring system if any), test results from an approved independent testing laboratory for the properties specified in Sec 2.1.2 of this specification, and certification for the reflective sheeting.

2.3.1.1 The independent testing laboratory report shall include the name of the manufacturer, brand name of the post, date of manufacture or lot number tested, and post dimensions.

2.3.1.2 The post manufacturer shall submit the sheeting manufacturer's test results for the specified properties of the reflective sheeting which will be used in the fabrication of the reflectorized flexible delineator posts. The report for the reflective sheeting shall also include the name of the manufacturer, brand name of the sheeting, color and lot, run number or date of manufacture of the material tested.

2.3.1.3 Upon approval of the test reports for the flexible post and the reflective sheeting, the manufacturer's brand name will be placed on a prequalified list.

2.3.1.4 Acceptance. Prior to installation of the posts the manufacturer of the posts shall submit a certification to the engineer certifying that the posts and reflective sheeting furnished are of the same composition as originally prequalified for manufacturer and brand name approval and in no way has been altered or changed. Final acceptance will be based upon brand name, satisfactory manufacturer's certification and any sampling or testing deemed necessary by the engineer.

3.0 CONSTRUCTION.

3.1 The posts shall be installed 2 feet off the edge of the shoulder or as shown on the plans. Driven posts shall be installed so that the reusable anchor or bottom tip of the post, as applicable, is a minimum of 17 inches in depth from the ground surface. The posts shall be installed vertically, and any post damaged to the extent it is considered unfit for use by the engineer shall be removed and replaced by the contractor without any additional cost to the Commission.

4.0 Basis of payment. The accepted quantity of flexible delineator posts will be paid for at the unit price for each of the pay items included in the contract. No direct payment will be made for reflective sheeting or post anchors.